Model "D" Fre-Heater®

INSTALLATION AND OPERATION MANUAL

Part No. 8800430

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Model “D” Fre-Heater

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Table of Contents

Table of Contents

Section 1.0 – Introduction

1.1 DESCRIPTION OF THE SYSTEM

The Mueller® Model "D" Fre-Heater® is designed to recover heat removed by refrigeration or air conditioning systems. It is a de-superheater that removes most or all of the sensible heat from the compressor's hot discharged gas and uses the existing condenser to remove the remaining heat to condense the refrigerant.

Model "D" Fre-Heaters are CSA-listed, fully insulated, double-wall heat exchangers that can operate on any potable water supply. All Model "D" Fre-Heater water tanks are rated for 150 psi working pressure and are fitted with two corrosion protection anodes. Refrigeration circuits are rated for a maximum working pressure of 426 psi.

Mueller DE-120 Fre-Heaters have one 240 VAC, single phase, 4,500-watt electric element located in the upper portion of the tank. The placement of this element allows for maximum utilization of the refrigerant heat recovery system and minimizes the usage of electricity in directly heating the water. An alternate 6,000-watt electric element is also available.

The outer jacket of a Model "D" Fre-Heater is corrosion-resistant stainless steel that will remain bright and rust free with a minimum of care. In coastal areas where the air contains a high salt content, the bright appearance of the Fre-Heater can be maintained by rubbing it with oil or a light grease as soon as it is installed. Abrasive cleaning materials or compounds should not be used on the outer jacket, as it may scratch the surface.

IMPORTANT: Fre-Heaters are not normally suitable for use on capillary tube refrigeration systems. Fre-Heaters are not intended to and should not replace normal air- or water-cooled condensers.

1.2 TECHNICAL SUPPORT

This manual provides basic installation and operating information to ensure safe and optimum performance of the Mueller Fre-Heater. Please contact your local Paul Mueller Company Sales and Service Representative if you require additional technical assistance pertaining to installation or operation procedures.

Manufacturer's support is available by contacting:

Paul Mueller Company
1600 West Phelps Street
Springfield, Missouri 65802
Direct Telephone: 1-800-756-5991
Facsimile: 1-800-436-2466
Email: DFETechService@paulmueller.com

1.3 CAPACITY

The Model "D" Fre-Heater is designed for use with air- or water-cooled condensing units. The size of the units and refrigeration systems on which each model may be used are shown in Table 1. Dimensions of the various models of Model "D" Fre-Heaters are shown in Figures 1 to 4.

The amount of hot water Model "D" Fre-Heaters generate will vary, depending on the running time and the size of the refrigeration system.

TABLE 1: MODEL "D" FRE-HEATER TECHNICAL SPECIFICATIONS

Model No.	Mueller Part No.	No. of Refrig. Circuits	Refrigeration Connection Size	Per Circuit Refrig. Capacity[5]	Water Connection Size	Height	Diameter	Water Tank Capacity (gal)	Approx. Shipping Weight (Lb)	Approx. Loaded Weight (Lb)
D-50	8823750	1	⅝" ODM	.5 thru 4	¾" FPT	54"	21¾"	50	225	600
D2-50	8823751	2	⅝" ODM	.5 thru 4	¾" FPT	54"	21¾"	50	225	600
D-80	8823780	2	¾" ODM	1 thru 5	¾" FPT	59"	25¼"	80	300	940
D-120	8823821	2	¾" ODM	1 thru 7.5	1½" FPT	62"	29½"	119	430	1,300
D2-120	8823820	2	1⅛" ODM	3 thru 15	1½" FPT	62"	29½"	119	430	1,300
D2-120A[3]	8823817	2	1⅛" ODM	3 thru 15	1½" FPT	62"	29½"	119	430	1,300
DE-120[1]	8823822	2	1⅛" ODM	3 thru 15	1½" FPT	62"	29½"	119	430	1,300
DH-120[3]	8823823	2	1⅝" ODM	7 thru 35	1½" FPT	62"	29½"	119	440	1,300
DHS-120	8825141	1	1⅝" ODM	14 thru 70	1¼" FPT	62"	29½"	119	440	1,300
DHSE-120A4[1]	8825142	1	1⅝" ODM	14 thru 70	1¼" FPT	62"	29½"	119	440	1,300
DHSE-120B4[1]	8825143	1	1⅝" ODM	14 thru 70	1¼" FPT	62"	29½"	119	440	1,300
DHSE-120A6[2]	8825213	1	1⅝" ODM	14 thru 70	1¼" FPT	62"	29½"	119	440	1,300
DHSE-120B6[2]	8825214	1	1⅝" ODM	14 thru 70	1¼" FPT	62"	29½"	119	440	1,300
DA-120[4]	8823826	2	1" MPT	5 thru 25	1½" FPT	62"	29½"	119	440	1,300

[1] Units have one 4,500-watt electric element ("A" = 208–230/60/1 and "B" = 460/60/1).
[2] Units have one 6,000 watt electric element ("A" = 208–230/60/1 and "B" = 460/60/1).
[3] Aquastat included.
[4] Ammonia only.
[6] Refrigeration tonnage capacities are evaporator tons and not heat of rejection tons.
Conditions for the capacities are: 30°F evaporator, 110°F condensing temperature, and 50°F discharge gas superheat.
Pressure drop through the Fre-Heater refrigeration circuit will be approximately 15 psi at the maximum tonnage application.
Pressure drop at the mid-range tonnage will be approximately 5 to 7 psi.
The highest percentage of heat recovered per ton is usually obtained at or below the mid range of the refrigeration tonnage capacity.

Section 2.0 – Installation

2.1 INSPECTION

Each shipment should be carefully checked for shortages or concealed damage. Any shortage or damage must be reported to the delivery carrier at the time of delivery.

Damaged material becomes the delivery carrier's responsibility and should not be returned to the manufacturer unless prior approval is obtained.

2.2 FRE-HEATER LOCATION

Mueller Model "D" Fre-Heaters should be located indoors. If necessary to locate the Fre-Heater outside, it must be under a cover and protected from water dripping, spraying, or in any way collecting on the top surface, as this can result in the failure of the heat exchanger.

When selecting a location for a Model "D" Fre-Heater, the ability of that location to bear the loaded weight of the Fre-Heater should be a prime consideration. The loaded weights of all Model "D" Fre-Heaters are listed in Table 1.

Model "D" Fre-Heaters must be protected from freezing. Particular attention should be directed to protecting the water piping going to and from the Fre-Heater.

The Model "D" Fre-Heater should be located as near as practical to the condensing unit(s). The Fre-Heater should not be located where cooling tower or evaporative condenser water will be in continual direct contact with the exterior surface. Careful planning of the Fre-Heater location and plumbing can reduce installation costs and save time during installation and on maintenance in the future.

See Figures 1, 2, 3, and 4 for dimensions. Provide adequate space between walls and the Fre-Heater for convenient access to all piping connections. See suggested refrigerant piping diagrams shown in Figures 10, 11, and 12.

2.3 LEVELING

Three large cap screws are provided with the Model "D" Fre-Heater to raise it above the floor and level it. The cap screws should be screwed out enough to raise the tank slightly before setting it in place and then adjusted as needed to level the unit. The legs provided will allow the Fre-Heater to be raised approximately 1". Should more height be needed, a leg kit (Mueller Part No. 8801890) is available to raise the Fre-Heater approximately 5½" off the floor.

FIGURE 1: 50-GALLON MODEL "D" ¾" WATER CONNECTION TANK

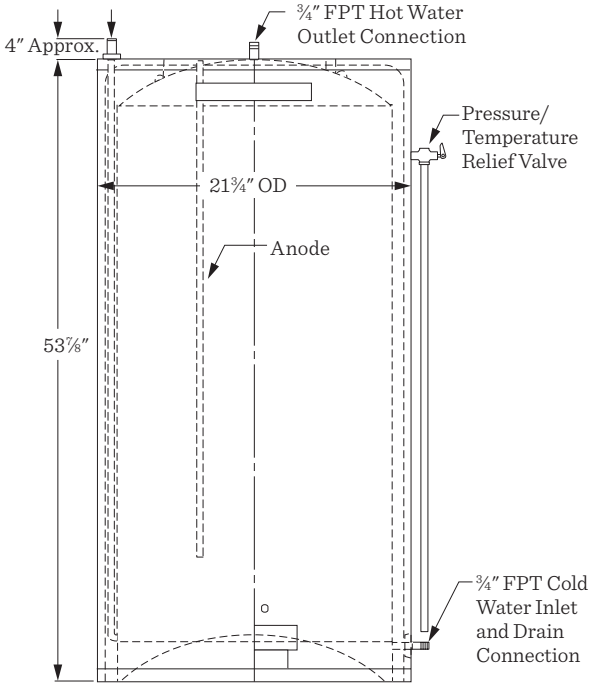


FIGURE 2: 80-GALLON MODEL "D" ¾" WATER CONNECTION TANK

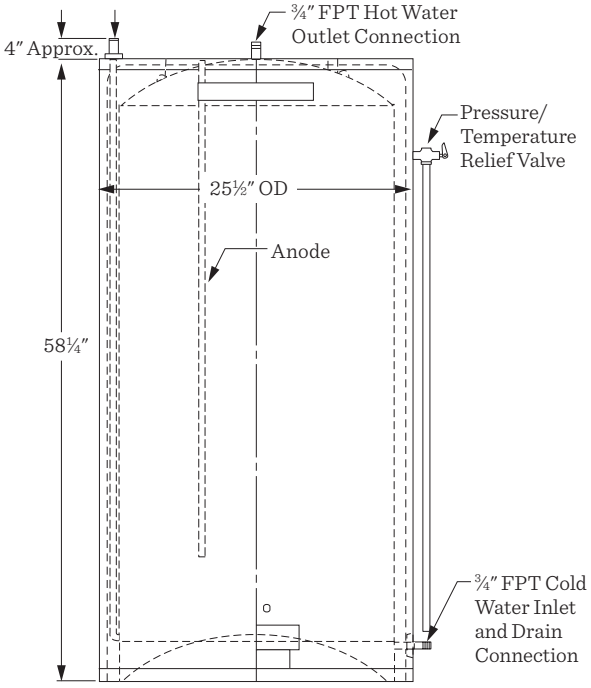


FIGURE 3: 119-GALLON MODEL "D" FRE-HEATER 1½" WATER CONNECTION TANK

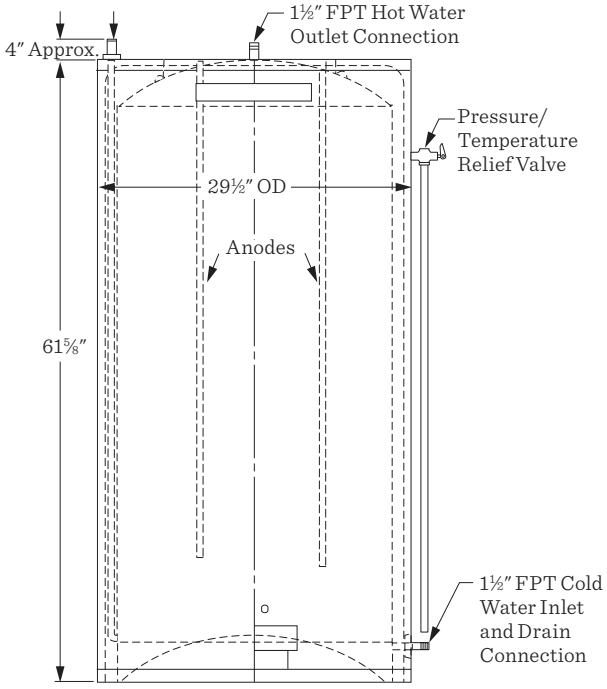
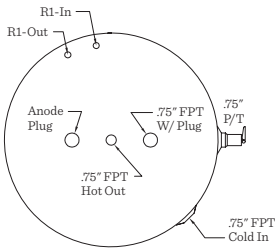
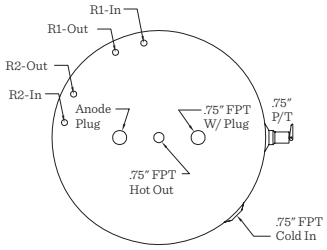


FIGURE 4: FRE-HEATER TOP HEAD LAYOUT: WATER CONNECTIONS, ANODE LOCATIONS, AND REFRIGERANT PIPING



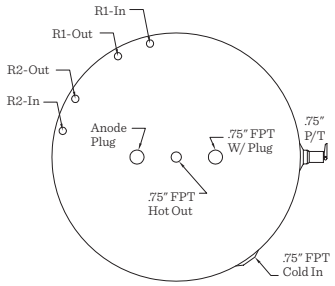
50-GALLON MODEL "D" FRE-HEATER

.75" FPT Water Connections
.625" ODM Refrigeration Connections



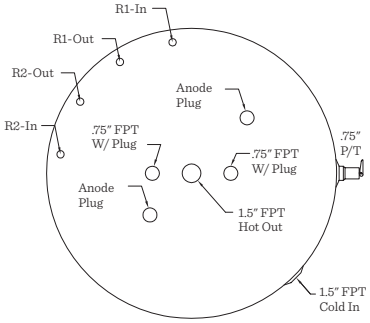
50-GALLON MODEL "D2" FRE-HEATER

.75" FPT Water Connections
.625" ODM Refrigeration Connections



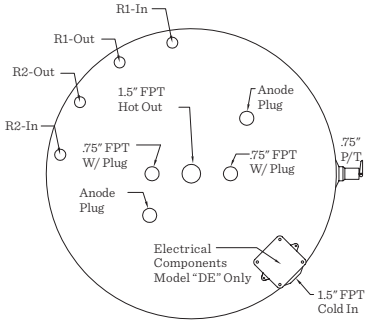
80-GALLON MODEL "D" FRE-HEATER

.75" FPT Water Connections
.75" ODM Refrigeration Connections



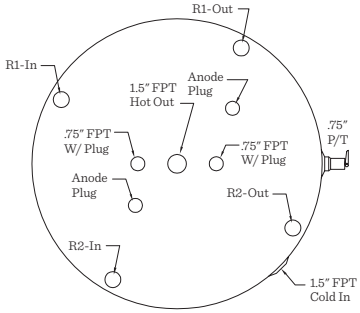
120-GALLON MODEL "D" FRE-HEATER

1.5" FPT Water Connections
.75" ODM Refrigeration Connections



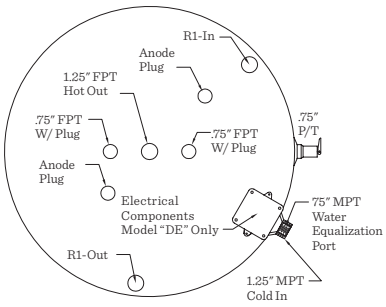
120-GALLON MODEL "D2" AND "DE" FRE-HEATER

1.5" FPT Water Connections
1.125" ODM Refrigeration Connections



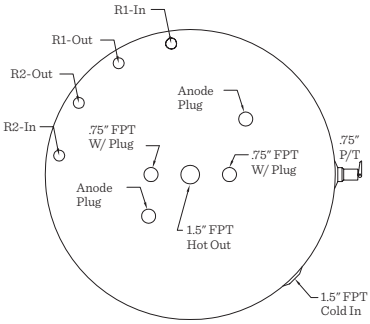
120-GALLON MODEL "DH" FRE-HEATER

1.5" FPT Water Connections
1.625" ODM Refrigeration Connections



120-GALLON MODEL "DHS" AND "DHSE" FRE-HEATER

1.25" FPT Water Connections
1.625" ODM Refrigeration Connections



120-GALLON MODEL "DA" FRE-HEATER

1.5" FPT Water Connections
1" MPT Refrigeration Connections

2.4 INSTALLING WATER PIPING

The Model "D" Fre-Heater is equipped with ¾" or 1½" connections for the cold water inlet and the hot water outlet, depending on the specific model (refer to Table 1).

The water inlet connection is labeled "COLD" and the outlet connection is labeled "HOT."

The pipe from the "HOT" outlet should go to the conventional water heating system, if one is being used. Please see Figures 5 and 6.

FIGURE 5: TYPICAL HOT WATER DUMP VALVE PIPING

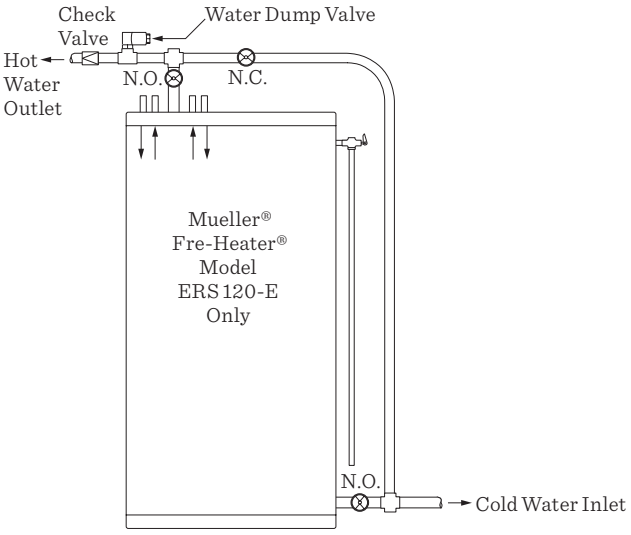
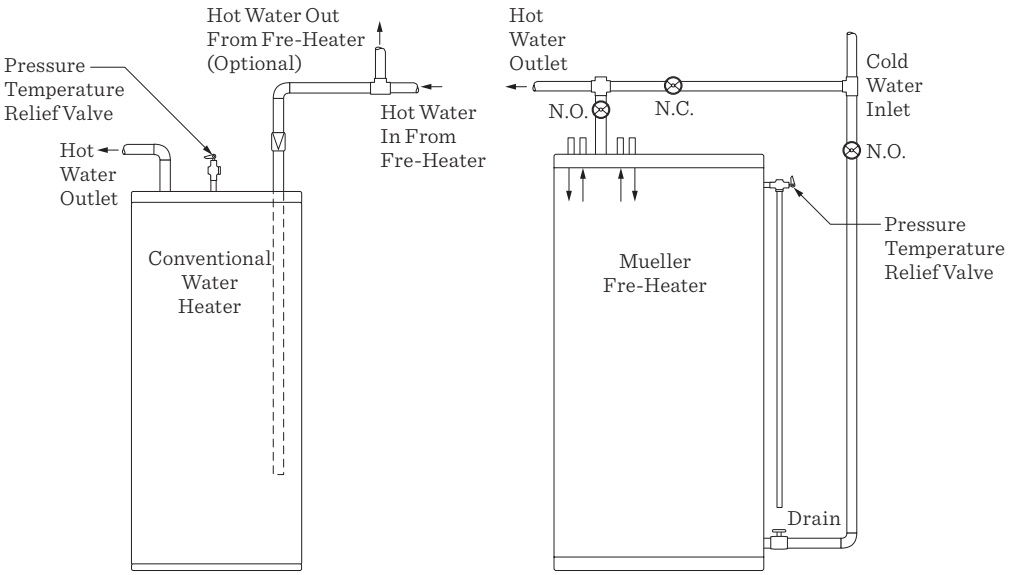


FIGURE 6: TYPICAL PLUMBING FOR FRE-HEATER WATER CONNECTION



2.4 INSTALLING WATER PIPING (CONTINUED)

A cold water bypass line should always be provided so the Fre-Heater(s) can be bypassed for service without shutting down the total water heating system.

Particular care should be paid to the hot water outlet connection on Fre-Heaters with 1½" FPT water connections. A pipe nipple (preferably brass) should be used so this joint can be securely tightened and retightened should it become loose. A copper pipe thread to sweat connector should not be used for this connection.

IMPORTANT: Be sure there are no leaks at the water connections that might cause the insulation to become wet.

IMPORTANT: To reduce the risk of excessive temperatures and pressures in this water heater, a pressure temperature relief valve has been installed by the manufacturer and should not be removed. This valve should be provided with a ¾" drain line oriented so any discharge from the valve will exit within 6" above or at any distance below the structural floor and cannot contact any live electrical part. The discharge opening must not be blocked or reduced in size under any circumstances. Any additional protective equipment required by local codes must also be installed. In the event the pressure temperature relief valve is damaged or otherwise needs replacement, a combination pressure and temperature relief valve, certified by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment, as meeting the requirements for ANSI Z21.22, "Relief Valves for Hot Water Supply Systems," should be installed. The valve must be marked with a maximum set pressure of 150 psig for use on all Model "D" Fre-Heaters.

For commercial applications, an electrically operated water dump valve (Mueller Part No. 8824074) is provided to be installed on the outlet side (hot) of the Model "DE" Fre-Heater (see Figure 5). It should be screwed into a ¾" FPT tee fitting and installed either at the tank outlet or at a more convenient location downstream of the Fre-Heater. If the Fre-Heater is a part of a multiple water heater system, a check valve should be installed in the hot water line following the dump valve. This valve is a part of the temperature regulating/limiting system for the Fre-Heater and should not be bypassed or ignored; however, an optional hot gas bypass can be used in place of the water dump valve. Since the water dump valve may discharge scalding water when the tank exceeds 180°F in temperature, precaution should be taken to divert or direct the flow of this valve to a safe place, preferably a drain. Piping should be supported on both sides of the valve to avoid damaging the valve body.

IMPORTANT: If a water mixing valve is installed in the system, make sure that check valves are in both hot and cold water lines. If this precaution is not taken, hot water may be drawn into the cold water system under certain system operating conditions.

In some Fre-Heater systems, as in some standard water heating systems, thermal expansion of the water as it is being heated can be great enough to cause the pressure temperature relief valve to leak or open. Should this be a problem, we recommend the installation of a thermal expansion tank. See Section 6.0, "Appendix A."'

A "Therm-X-Trol" thermal expansion absorber or similar product can be piped in the system. For proper sizing of the expansion tank, please consult your supplier. Typically, an expansion tank having a volume of 10 or more gallons would be required for a Model "D" Fre-Heater with a water temperature of 140°F. See Appendix A for installation procedures. A thermal expansion absorber is provided with all dairy farm models.

2.4 INSTALLING WATER PIPING (CONTINUED)

Some plumbing codes require the installation of dielectric unions in the water lines connected to any water heating devices. This code would include Fre-Heaters. The purpose of a dielectric union is to interrupt the flow of transient or induced voltage in the water piping that would increase the corrosive activity of the water. Mueller strongly recommends the use of dielectric unions in all Fre-Heater installations.

In many multiple-unit D-120 installations, it is advantageous to install a circulating pump and form a loop plumbing circuit through the Fre-Heaters. Doing so will usually increase the system's heat recovery efficiency by keeping the total system's water volume at a uniform temperature and picking up the most available heat from any condensing units that may be running. See Figure 7 for typical plumbing. Consult a plumbing supply house for a hot water circulating pump suitable for the particular installation. All pumps used in a Fre-Heater water circulation system must be suitable for potable water use. The Mueller hot water circulating pump, Part No. 8801091, is suitable for many installations. Multiple Fre-Heater installations may be piped in parallel if care is taken to assure equal flow through all of the Fre-Heaters. Parallel plumbing is usually reserved for installations having a common refrigeration compressor on all of the Fre-Heaters. Refer to Figure 8 for a typical parallel plumbing diagram.

Under certain circumstances, it may be necessary to operate a high temperature or booster heater loop at temperatures above those attainable or desirable in the Fre-Heater. At those times, a piping scheme such as shown in Figure 9 should be used. This allows the Fre-Heater to operate at its optimum heat reclaim while the system temperature is at a higher level.

FIGURE 7: TYPICAL MULTIPLE-UNIT SERIES PLUMBING FOR FRE-HEATERS (COMMERCIAL APPLICATIONS)

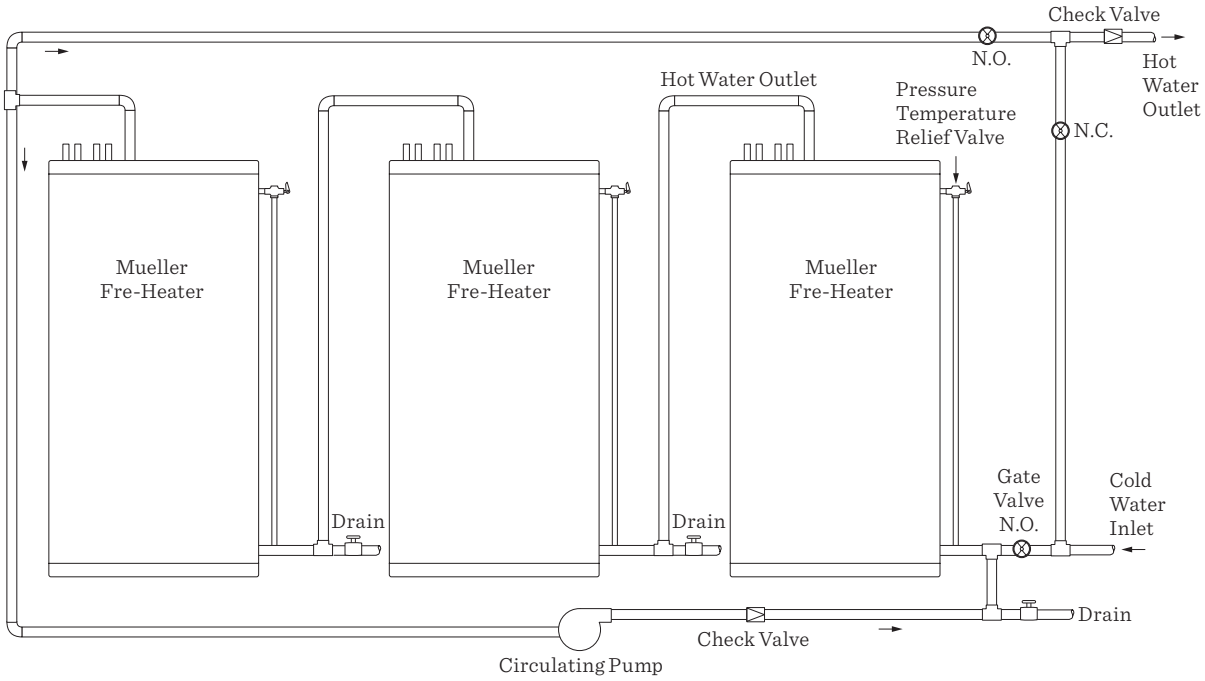


FIGURE 8: TYPICAL MULTIPLE-UNIT PARALLEL PLUMBING FOR FRE-HEATERS

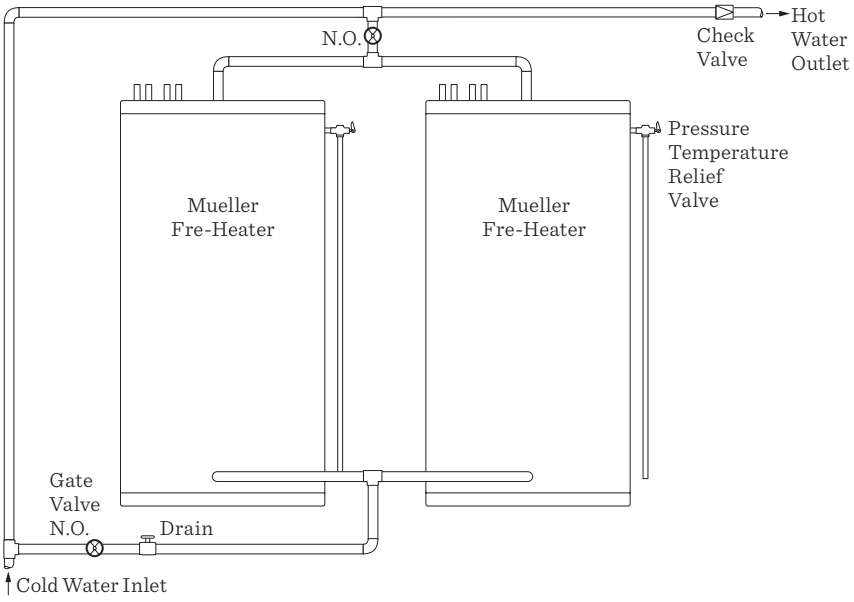
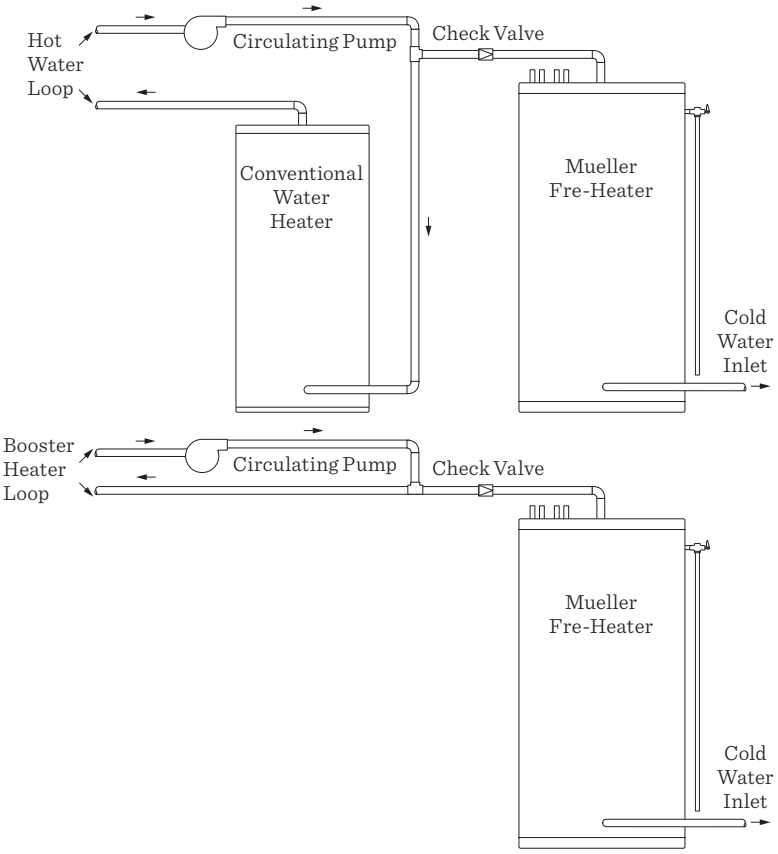


FIGURE 9: FRE-HEATER PIPING SCHEME



2.5 REFRIGERATION CONNECTIONS

Mueller Fre-Heaters are shipped with a dry nitrogen holding charge that must be removed from the Fre-Heater piping before the installation of refrigerant piping.

Good refrigeration practices must be used while installing the Fre-Heater. These practices are of common knowledge to experienced refrigeration service technicians, and only a certified, experienced refrigeration service technician should undertake the refrigeration connection portion of a Fre-Heater installation.

Inlet and outlet stubs are copper tube for Freon applications and stainless steel male pipe thread for ammonia applications. Refrigeration connection sizes for various models of Fre-Heaters are shown in Table 1.

Refrigerant line sizing to and from the Fre-Heater is determined by refrigerant specifications. Please see the condensing unit installation manual for recommendations. If there is any question about refrigerant line sizing, follow the equipment manufacturer's recommendation.

In most instances, refrigerant line runs of over 50 feet should not be used. If a refrigerant line run of over 50 feet is used, particular care must be taken to avoid oil traps and excessive pressure drop in the lines.

CAUTION: Refrigerant lines going to and from Mueller Fre-Heaters could reach temperatures of 300°F. Refrigerant lines must be insulated to prevent personal injury or other risks when near combustible substances. The insulation will also add to the efficient operation of the Fre-Heater.

If it is necessary to cut openings into the air conditioning or refrigeration cabinet when making tubing connections, the following must be observed and provided for. Particular care must be taken if the equipment is located outdoors:

- Integrity and rain tightness of the cabinet must be maintained.
- Do not cut into a control box or enclosure containing live mechanical parts or electrical wiring. Make openings below any enclosures containing live mechanical parts or electrical wiring.
- Tubing must be protected against mechanical damage by the cabinet. Protective bushings are recommended.
- Tubing connections must be made by means of high-temperature soldering or brazing.
- Tubing must be routed such that no possibility of contacting moving parts occurs.
- Provide protection for the tubing if the likelihood of accidental damage occurring exists.
- Always use a gear-type tubing bender when making bends in ¾" or ⅞" OD tubes. A conduit bender will flatten the tubing and restrict the flow of refrigerant.
- When installing tubing through walls or along a structural member, ensure the tubing is isolated from the members to avoid any transmissions or vibrations that might occur.

2.5 REFRIGERATION CONNECTIONS (CONTINUED)

Consult Table 1 for the per circuit condensing unit capacity range of Model "D" Fre-Heaters. Stay within the capacity range specified to assure proper condensing unit operation.

A condensing unit exceeding the single circuit capacity of a specific Model "D" or "DE" Fre-Heater may be connected to two or more Fre-Heater circuits on one or more Fre-Heaters having a combined circuit capacity equal to the condensing unit (see Figure 11).

When making multiple Fre-Heater circuit connections to a single condensing unit, piping to the Fre-Heater circuits should be in parallel. Series piping (through one circuit into another) of the Mueller Fre-Heater should not be used.

A refrigerant line discharge muffler is not necessary for proper operation or warranty coverage in a Fre-Heater installation. However, if the Fre-Heater is to be installed in an area where any machine noise would be objectionable, a discharge muffler should be considered as a method of eliminating the normal compressor pulsation noise present in all refrigeration systems.

Typical condensing unit piping is shown in Figures 10, 11, and 12.

NOTE: Horizontal installation may be used in ammonia refrigerant applications to provide a positive flow of oil from the Fre-Heater.

If there is a hot gas defrost valve, an oil separator, and/or a discharge muffler in the compressor discharge line, the Fre-Heater must be installed downstream of those items. See Figure 13 for an illustration of this.

In the event of extended compressor operation with little or no water usage, it is possible to generate water temperatures that exceed the 210°F setting of the pressure temperature relief valve. This will result in repeated dumping of hot water through the relief valve.

To avoid the repeated release of hot water by the pressure temperature relief valve, a correctly sized three-way heat reclaim valve, a transformer, and an immersion Aquastat (or its equivalent) should be installed. Installation and operation instructions for the above bypass system are included with these instructions for your reference. A straight-through solenoid valve may be used in lieu of the three-way valve if it is rated for hot gas operation and the port size is large enough to allow unrestricted refrigerant flow.

For maximum condensing unit efficiency and Fre-Heater heat recovery, head pressure controls must be used.

On air-cooled condensing units, head-pressure-operated fan controls must be installed; and on water-cooled condensing units, a head-pressure-operated water valve must be installed, if one is not already on the condensing units. On many low temperature applications, an auxiliary cooling fan must be installed on the compressor if the condenser fan is cycled to maintain head pressure. Consult the compressor manufacturer for their recommendation if in doubt of sufficient air flow for compressor cooling.

2.6 HEAT PUMPS

Mueller Model "D" Fre-Heaters may be used on commercial heat pump systems with the following precautions:

- Heat pumps are normally sized for the air conditioning design load with supplemental heat added to carry the heating load during low ambient operating conditions.
- Most commercial heat pumps have more than enough heating capacity at ambient temperatures of 40°F and above to provide space heat and reclaim heat for water heating.
- The Fre-Heater is a heat removing device; if the heat that it will be removing from the system will materially affect the space heating capacity, it should be bypassed when the ambient temperature drops below 40°F. This may be done by using a heat reclaim valve in a similar manner as for water temperature control. In this application, the valve will be controlled by an outdoor thermostat.
- When the Fre-Heater is bypassed for low ambient operation, any condenser (outdoor coil) head pressure fan switches must also be bypassed so the fan will run continuously in the heating mode. The water temperature limit/hot gas bypass valve must also be wired so it is not actuated during the defrost cycle. See Figure 14 for a refrigeration piping schematic.

2.7 ICE MACHINES

Generally, a Fre-Heater may be installed on water-cooled ice machines and remote condenser air-cooled ice machines. These machines are usually equipped with large capacity receivers, pump down controls, and head pressure controls. If a Fre-Heater is to be installed on a self-contained, air-cooled expansion valve refrigerant control ice machine, the same modifications may be required as when a remote air-cooled condenser is used. Should there be any question concerning the adverse effect of a Fre-Heater on the proper operation of any particular ice-making machine, Paul Mueller Company and/or the ice machine manufacturer should be consulted ***prior*** to the installation of the Fre-Heater.

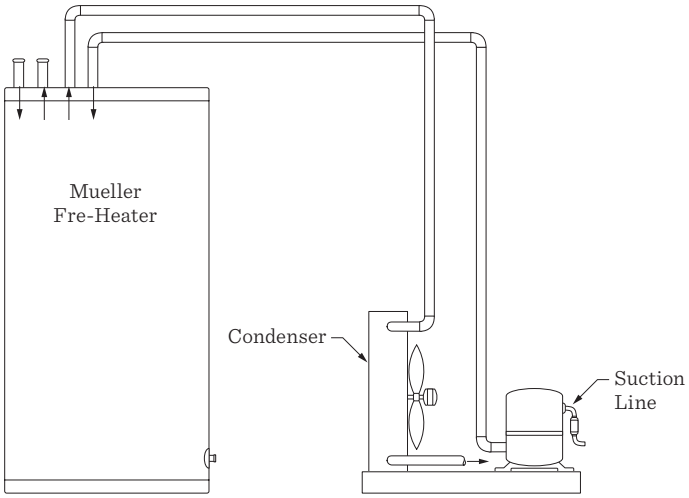
2.8 REFRIGERANT CHARGE

It may be necessary to add additional charge in some refrigeration systems. Check the sight glass and, if necessary, add refrigerant to clear the sight glass. Final charging of the system must be done after the water in the Fre-Heater becomes warm.

2.9 TEST RUN

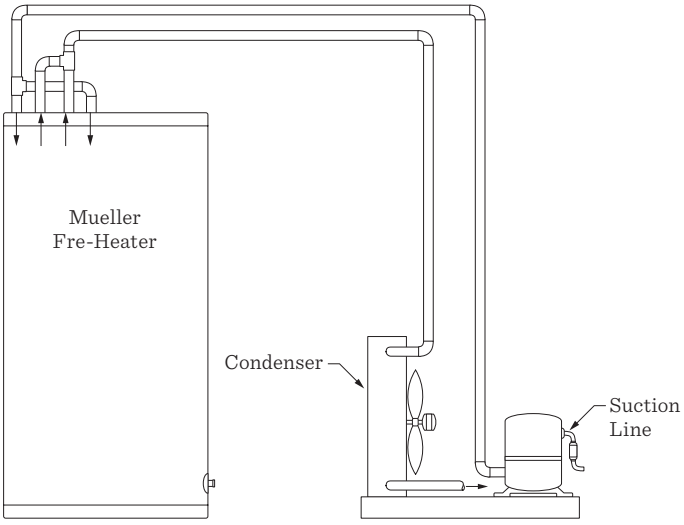
Turn on the water supply and fill the Model "D" Fre-Heater with water. Ensure that all water and refrigeration connections are leak free. The unit is then ready for use. Refrigerant charge should be checked after the system has achieved normal operating conditions. Be sure to check for proper operation of any and all controls, valves, etc., installed with or changed during the installation of the Fre-Heater, both in the refrigeration and water systems.

FIGURE 10: TYPICAL REFRIGERATION CONNECTIONS FOR A SINGLE CONDENSING UNIT AND SINGLE-CIRCUIT PIPING



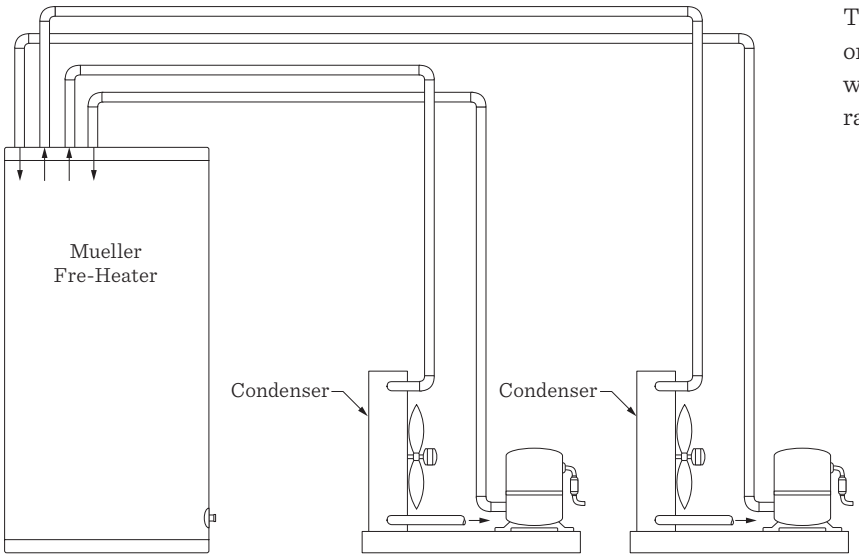
This piping configuration should only be used for a condensing unit having a capacity equal to or less than the single circuit rating, as shown in Table 1.

FIGURE 11: TYPICAL SINGLE CONDENSING UNIT WITH MULTIPLE-CIRCUIT PIPING



This piping configuration should only be used for a condensing unit having a capacity above the single circuit rating, but not exceeding the multiple circuit rating, as shown in Table 1.

FIGURE 12: TYPICAL DUAL CONDENSING UNIT PIPING



This piping configuration should only be used for condensing units within the range of the per circuit ratings, as shown in Table 1.

FIGURE 13: FRE-HEATER LOCATION WITH HOT GAS DEFROST VALVE, OIL SEPARATOR, AND/OR DISCHARGE MUFFLER IN SYSTEM

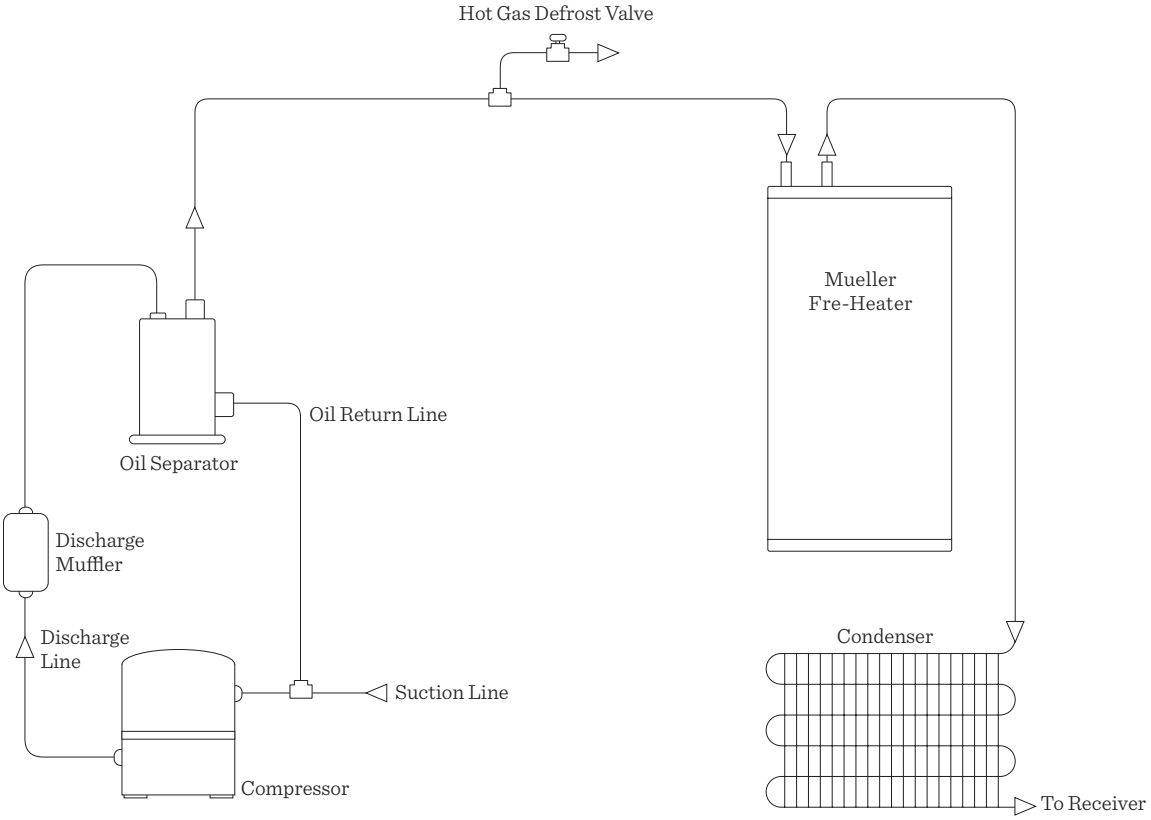
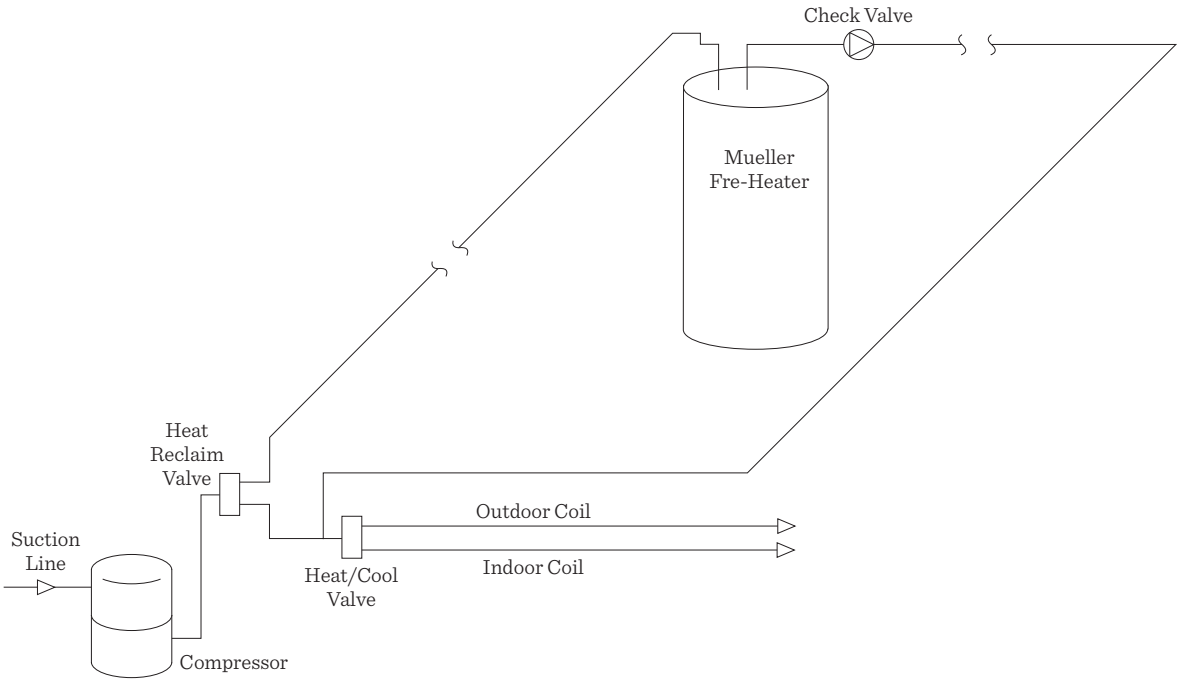


FIGURE 14: TYPICAL HEAT PUMP REFRIGERANT PIPING DIAGRAM



2.10 ELECTRICAL CONNECTIONS FOR MODEL "DE" FRE-HEATER

A separate 30 A, 240 V branch circuit must be installed by a qualified electrician for heating element operation. In addition, a 24 V line from the condensing unit circuit must be connected to the regulating/limiting thermostats and solenoid. All wiring must comply with the National Electrical Code and any local codes.

The electric heating element is prewired to the conduit box in the top of the Fre-Heater. Supply circuit connections should be made to the red and black wires in this compartment. The supply circuit ground must be connected to the green grounding lug in the conduit box to protect the user from possible electrical shock. Use only copper conductors for these connections. See Figure 15 for a wiring schematic.

A separate circuit for regulating the refrigerant heated water temperature must originate from the condensing unit power supply circuit. It should be protected with a 5 A in-line fuse. This circuit connects the thermostats on the water heater in series with the water dump valve (or the optional hot gas bypass solenoid). Class I wiring should be used in the circuit. See Figure 15 for connection details.

DANGER: When installing or servicing electrical components on this unit, turn both the heating element and condensing unit power supplies off to avoid the possibility of electrical shock.

IMPORTANT: The tank must be full of water before the power is turned on. The heating element will be damaged if it is energized even for a short period of time while the tank is empty.

2.11 SPECIAL MODEL "DE" FRE-HEATER OPERATING INSTRUCTIONS

The electrical heating element in Model "DE" Fre-Heaters allows a reserve of hot water to be stored in the top of the tank when the condensing unit usage is low or when high water output is desired. The thermostat for the electric heating element has been set at the factory for 140°F to reduce the risk of a scald injury. Should it be necessary to change this setting, turn off the power to both the water heater and the condensing unit, remove the access plate, and adjust the temperature pointer to the desired temperature (shown approximately on the dial) with a screwdriver. Be careful not to disturb the plastic shield covering the electrical connections. The use of higher settings for the thermostat reduces the amount of savings that the refrigerant heat recovery provides.

DANGER: Hydrogen gas can be produced in a hot water system served by this heater that has not been used for a long period or time (generally two weeks or more). Hydrogen gas is extremely flammable. To reduce the risk of injury under these conditions, it is recommended that a hot water faucet be opened for several minutes before using any electrical appliance connected to the hot water system. If hydrogen is present, there will probably be an unusual sound such as air escaping through the pipe when the water begins to flow. There should be no smoking or open flame near the faucet at the time it is open.

The electrical heating element circuit contains controls that disconnect the electrical power to the element should the tank water temperature rise above 190°F. This is a non-resetting control, so it will need to be reset each time the tank temperature reaches 190°F.

2.12 MAINTENANCE

In order to achieve the maximum life from Model "D" Fre-Heaters, the following should be done annually:

1. Remove and check at least one of the two anode rods. If the anode is 33% or more consumed, both anode rods should be replaced.

2. Drain and backflush the water tank running enough water from the water inlet or drain to remove all loose scale that has collected in the bottom of the water tank.

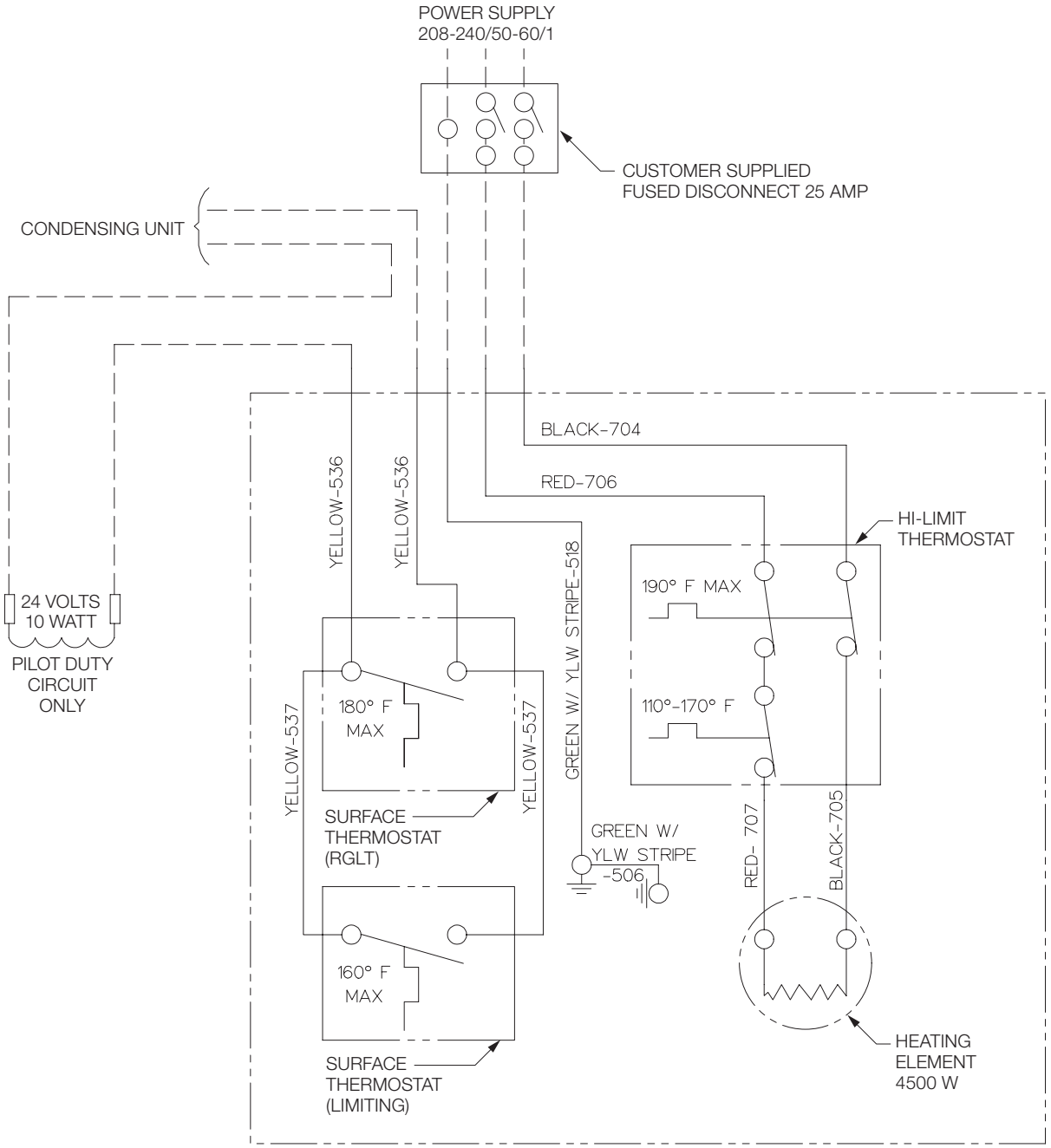
3. Check the operation of the pressure temperature relief valve by manually operating it to see that it will freely flow water should it be required to do so. If there is any doubt that it will not function properly, replace it.

4. Check all water fittings, valves, etc. to be sure there are no water leaks. Repair as necessary.

5. Check the operation of all controls, such as the hot gas bypass valve, Aquastat, electric element controls, refrigeration head pressure controls, or any other controls necessary, for the proper operation of the Mueller Fre-Heater and the refrigeration and/or air conditioning systems it is connected to.

NOTICE: All illustrations and diagrams in these instructions are schematic suggestions only and do not attempt to address all of the important design considerations, such as pipe sizing and configuration or the selection and placement of major system components. Every installation must follow known and accepted industry safety practices and various code or legal requirements.

FIGURE 15: MODEL "DE" FRE-HEATER WIRING SCHEMATIC



NOTES:

1. Wiring shown dotted is furnished by installer and must conform to applicable electrical codes.
2. If installed in Canada, wiring between the Fre-Heater and remote components must be field-wired to conform to requirements of Part 1 of the Canadian Electrical Code.
3. All enforced electrical codes must be followed during installation, service, and/or operation of this equipment.

Section 3.0 – Water Temperature Limit and Three-Way Heat Reclaim Valve

3.1 SOLENOID VALVE INSTALLATION

The three-way heat reclaim valve (Mueller Part Nos. 8827286 and 8827284) information is as follows:

- Refrigerant must be recovered before cutting the refrigerant lines to install the three-way heat reclaim valve.
- Accepted refrigeration practices must be used while installing the valve. These practices are of common knowledge to experienced refrigeration service technicians, and only an experienced service technician should undertake the installation of the solenoid valve.
- The valve's installation location should be as close as practical to the refrigeration compressor.
- The valve should be installed in a vertical position, coil up, and supported by hangers.
- A check valve must be installed in the refrigerant line between the Mueller Fre-Heater and the tee, as shown in Figure 17.
- Suggested refrigeration piping of the valve in a typical Model "D" or "DE" Fre-Heater system is illustrated in Figure 17. See Table 4 for check valve sizing.
- Piped in the suggested manner, the valve coil will be energized when water heating is needed. When the hot water demand is satisfied, the valve will be de-energized.

TABLE 2: THREE-WAY HEAT RECLAIM VALVES

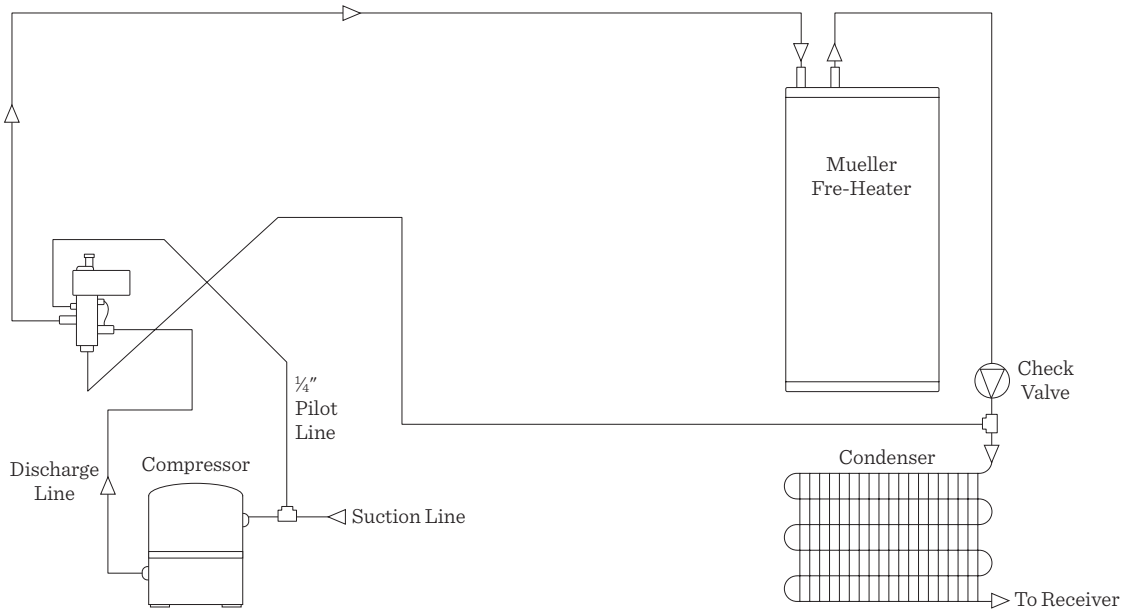
Mueller Part No.	MOPD (psi)	Maximum Rated Pressure (psi)	Standard Coil Ratings		Port Size	Connection Size
			Volts/Cycles	Watts		
8827286	300	500	24/50/60	15	⅝″	⅝″ ODF
8827284	300	500	24/50/60	15	1¼″	1⅜″ ODF

FIGURE 16: THREE-WAY HEAT RECLAIM VALVES

Part No. 8827286

Part No. 8827284

FIGURE 17: SUGGESTED REFRIGERATION PIPING OF VALVE FOR TYPICAL MODEL "D" OR "DE" FRE-HEATER SYSTEM

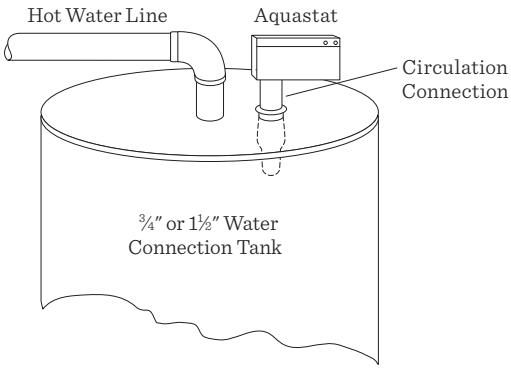


3.2 AQUASTAT INSTALLATION

- The Aquastat bulb well should be installed in a ¾" circulation connection located on the top head, as illustrated in Figure 18.

- The Aquastat bulb should be installed in the bulb well and the switch attached to the bulb well. A small amount of thermal mastic on the Aquastat bulb will make it more sensitive to water temperature changes and is recommended.

FIGURE 18: SUGGESTED AQUASTAT PIPING



3.3 ELECTRICAL INSTALLATION

- The three-way heat reclaim valves supplied by Paul Mueller Company are equipped with 24 V solenoid coils. A 24 V transformer (Mueller Part No. 8800145), 120 V /24 V, 40 VA or equal, must be used for proper operation. Two solenoid valves may be operated from one transformer.

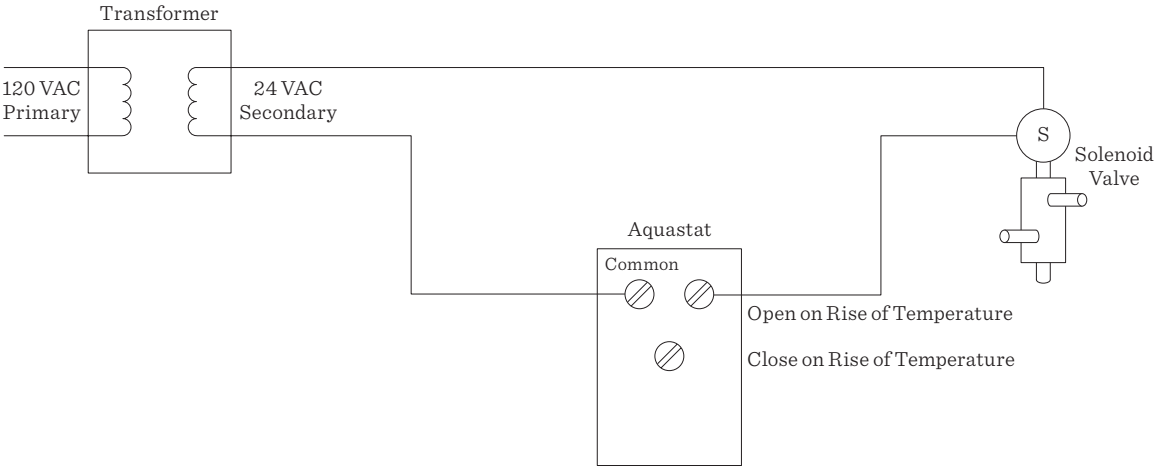
- The Aquastat (Mueller Part No. 8800144) is a universal control and care must be taken to wire the solenoid valve to the "common" and "open on rise" terminals. The "close on rise" terminals are NOT used.

- All electrical wiring must be done in accordance with National and local electrical codes.

- The transformer's 120 V primary circuit may be supplied from any convenient constant 120 V power source.

- The electrical components should be wired in accordance with the diagram in Figure 19.

FIGURE 19: WIRING OF ELECTRICAL COMPONENTS



3.4 CHECKOUT AND TEST RUN

- On completion of the Fre-Heater installation, the refrigeration system should be checked for leaks and proper charge. The water system should be checked for leaks and trapped air, and the solenoid valve should be checked for proper operation.

- To check the solenoid valve operation, run the system until the hot water demand is satisfied. The solenoid valve should de-energize, and the hot refrigerant gas should all be channeled directly to the condenser. Then draw off enough hot water to allow the solenoid valve to energize. The hot refrigerant gas should again be channeled through the Fre-Heater for water heating.

- The installation should not be considered complete until the valve operation has been fully checked out.

FIGURE 20: THREE-WAY HEAT RECLAIM VALVE DIMENSIONS

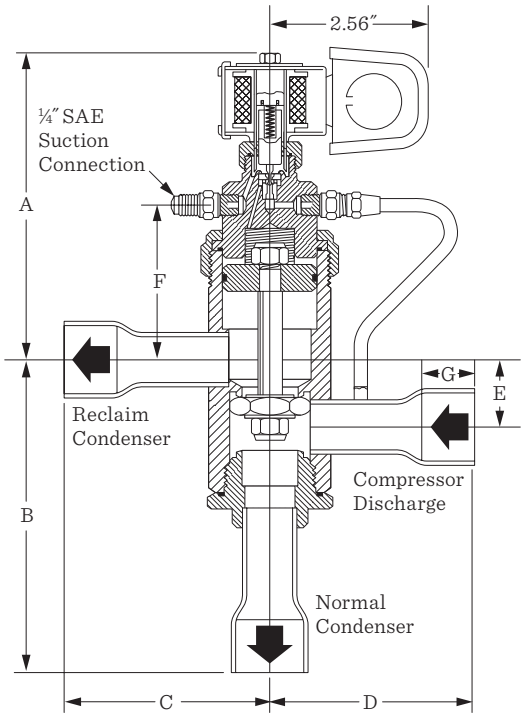


TABLE 3: THREE-WAY HEAT RECLAIM VALVE DIMENSIONS CHART

Part No.	Port Size (in)	Connection ODF Solder (in)	A (in)	B (in)	C (in)	D (in)	E (in)	F (in)	G (in)
8827286	⅝	⅝	5.00	4.36	3.22	3.22	.79	3.84	.50
8827284	1¼	1⅜	6.87	6.94	4.19	4.19	2.38	4.35	.97

TABLE 4: DISCHARGE CHECK VALVE SIZING

Part No.	Connection Size	Maximum Capacity
8820255	⅝″ ODF	4 Tons
8820260	⅞″ ODF	8 Tons

TABLE 5: CAPACITY (TONS) CHART FOR VALVE PORTS

Refrigerant	22							
Pressure Drop (psi)	2				4			
Port Size	⅝″	¾″	1¼″	2″	⅝″	¾″	1¼″	2″
Evaporator Temp (°F)								
40	4.7	10.1	29.1	70.0	6.6	14.2	41.8	100.0
30	4.7	9.9	28.6	68.7	6.5	13.9	41.0	98.7
20	4.6	9.7	28.0	67.4	6.3	13.7	40.2	96.8
10	4.5	9.5	27.4	66.0	6.2	13.4	39.4	94.5
0	4.4	9.3	26.8	64.5	6.1	13.1	38.5	92.5
-10	4.3	9.1	26.2	63.0	5.9	12.8	37.6	90.5
-20	4.2	8.9	25.5	61.5	5.8	12.5	36.7	88.1
-30	4.1	8.7	24.9	59.9	5.7	12.2	35.8	85.8
-40	4.0	8.4	24.2	58.2	5.5	11.8	34.7	83.5

Refrigerant	502							
Pressure Drop (psi)	2				4			
Port Size	⅝″	¾″	1¼″	2″	⅝″	¾″	1¼″	2″
Evaporator Temp (°F)								
40	3.7	8.0	23.4	56.2	5.2	11.2	33.6	81.0
30	3.6	7.8	22.8	54.9	5.1	10.9	32.8	78.7
20	3.6	7.6	22.2	53.4	4.9	10.7	31.9	76.6
10	3.5	7.4	21.6	52.0	4.8	10.3	31.0	74.5
0	3.4	7.2	21.0	50.4	4.7	10.1	30.2	72.3
-10	3.3	7.0	20.3	48.9	4.5	9.8	29.3	70.1
-20	3.1	6.7	19.7	47.3	4.4	9.4	28.3	67.8
-30	3.0	6.5	19.0	45.6	4.2	9.1	27.3	65.4
-40	2.9	6.3	18.3	44.0	4.1	8.8	26.3	63.0

Refrigerant	507							
Pressure Drop (psi)	2				4			
Port Size	⅝″	¾″	1¼″	2″	⅝″	¾″	1¼″	2″
Evaporator Temp (°F)								
40	4.1	8.8	25.7	61.6	5.7	12.3	36.9	88.3
30	4.0	8.5	25.0	60.0	5.5	12.0	35.9	86.0
20	3.9	8.3	24.3	58.3	5.4	11.6	34.9	83.6
10	3.8	8.0	23.5	56.5	5.2	11.2	33.8	81.0
0	3.6	7.8	22.8	54.7	5.0	10.9	32.7	78.4
-10	3.5	7.5	22.0	52.8	4.9	10.5	31.6	75.8
-20	3.4	7.3	21.2	50.9	4.7	10.1	30.5	73.0
-30	3.3	7.0	20.4	49.0	4.5	9.8	29.3	70.3
-40	3.1	6.7	19.6	47.0	4.3	9.4	28.1	67.4

Section 4.0 – Btuh Estimated Capacity

4.1 BTUH ESTIMATED CAPACITY INFORMATION

The estimated Btuh capacity per circuit for Model "D" and "DE" Fre-Heaters is shown in Table 6, "Fre-Heater Estimated Per Circuit Btuh Recovery," below, and is a useful tool for estimating heat recovery for Fre-Heaters. Note that this table is based on averages, and actual heat recovery will vary with the amount of superheat and other factors, such as equipment, installation, and operating conditions.

Input water temperature, refrigeration tonnage, refrigeration run time, and water flow rate are four of the more important variables that must be considered when estimating heat recovery. As a general rule, the greatest heat recovery will be obtained at water flows over 1.5 gpm and maximum water temperatures of 120°F or less.

It is difficult to accurately predict exact heat recovery because both the refrigeration and water systems are dynamic systems, and as such very seldom operate under any given set of conditions for a prolonged period of time.

TABLE 6: FRE-HEATER ESTIMATED PER CIRCUIT BTUH RECOVERY

D-50 Per Circuit		D2-50 Per Circuit		D2-80 Per Circuit		D-120, D2-120, DH-120, & DA-120 Per Circuit	
Tons	**Btuh**	**Tons**	**Btuh**	**Tons**	**Btuh**	**Tons**	**Btuh**
.5	4,000	.5	2,700	1.0	4,500	1.0	9,000
1.0	5,400	.75	3,600	1.5	6,000	1.5	13,000
1.5	7,200	1.0	4,200	2.0	8,000	2.0	14,000
2.0	8,400	1.5	5,900	3.0	11,500	3.0	16,000
3.0	11,800	2.0	7,500	4.0	13,000	4.0	19,000
4.0	15,000	2.5	8,400	5.0	14,500	5.0	20,000
		3.0	9,500			7.5 and up	22,000
		3.5	11,000				
		4.0	12,000				

Average Horsepower/Tons Conversion Chart*	
High Temperature Application (Air Conditioning):	1 HP = 1 Ton
Medium Temperature Application (Refrigerators and Ice Makers):	1 HP = .75 Ton
Low Temperature Application (Freezers):	1 HP = .5 Ton

**Use this table if the actual Btuh (tons) of cooling capacity is unknown.*

NOTES:
To use the above tables, all compressor sizes must be converted to tons.

Stay with refrigeration tonnages listed in Table 1, "Model "D" Fre-Heater Technical Specifications," when planning applications and estimating heat recovery.

The above tables are averages, based on 1 gpm or less flow rate and the average heat recovery of numerous installations. The actual heat recovery on any given installation may be higher or lower depending on a number of variable factors. Some of these factors are inlet water temperature, water flow rate, type of refrigeration equipment, type of refrigerant, condensing temperature, and refrigerant superheat. All variable factors must be considered when calculating actual heat recovery.

Section 5.0 – Fre-Heater Equipment Markings

5.1 LABEL NO. 8801149, WARNING: DISCONNECT POWER BEFORE SERVICING

⚠ WARNING

DISCONNECT BOTH CONDENSING UNIT AND FRE-HEATER® FROM MAIN POWER SUPPLY BEFORE SERVICING.

⚠ PELIGRO

ANTES DE EMPEZAR A DAR SERVICIO O REPARAR LA UNIDAD CONDENSADORA O EL FRE-HEATER®, ES INDISPENSABLE DESCONECTARIOS DEL SUMINISTRO DE CORRIENTE ELÉCTRICA.

⚠ AVERTISSEMENT

SEPAREZ L'UNITÉ RÉFRIGÉRANT ET FRE-HEATER® DU CÂBLE DE DISTRIBUTION AVANT DE RÉPARER.

8801149

5.2 LABEL NO. 8802732, WARNING: PRESSURE RELIEF VALVE MUST BE INSTALLED

⚠ WARNING

PRESSURE RELIEF VALVE LIMITING THE PRESSURE TO 1000kPA MUST BE INSTALLED!

⚠ AVERTISSEMENT

UNE SOUPAPE DE SÉCURITÉ LIMITANT LA PRESSION À 1000 kPA DOIT ÊTRE INSTALLÉ! 8802732

5.3 LABEL NO. 8801888, WARNING: HOT WATER

⚠ WARNING

HOT WATER CAN PRODUCE THIRD DEGREE BURNS IN 6 SECONDS AT 60°C (140°F), IN 30 SECONDS AT 54°C (130°F). THERMOSTATS WERE FACTORY SET AT 60°C+ (140°F). PLEASE CONTACT QUALIFIED SERVICE PERSONNEL FOR ADJUSTMENTS.

⚠ PELIGRO

EL AGUA CALIENTE PUEDE PRODUCIR QUEMADURAS DE TERCER GRADOS EN 6 SEGUNDOS A 60°C (140°F), EN 30 SEGUNDOS A 54°C (130°F), LOS TERMOSTATOS SE AJUSTARON EN LA FABRICA A 60°C+ (140°F) COMUNIQUESE CON PERSONAL CALIFICADO DE SERVICIO PARA ARREGLOS.

⚠ AVERTISSEMENT

MISE EN GARDE, L'EAU CHAUDE PEUT CAUSER DES BRULURES GRAVES EN 6 SECONDES, A 60°C (140°F), EN 30 SECONDES A 54°C (130°F), LES THERMOSTATS DE CE CHAUFFE-EAU ONT ETE REGLES A L'AVANCE A 60° C+ (140°F). POUR MODIFIER LES POINTS DE CONSIGNE DES THERMOSTATS CONSULTEZ UN SPECIALISTE.

8801888

5.4 LABEL NO. 8800996, COPPER CONDUCTOR

USE COPPER CONDUCTORS ONLY

5.5 LABEL NO. 3791, HOT

HOT
3791

5.6 LABEL NO. 3792, COLD

COLD
3792

5.7 LABEL NO. 9901403, IN

IN
9901403

5.8 LABEL NO. 9901404, OUT

OUT
9901404

5.9 LABEL NO. 8800215, PRESSURE RELIEF

PRESSURE RELIEF
7901 8800215

5.10 LABEL NO. 8822705, CSA LR 67608 AND USK

C US
LR67608
NPI 8822705

5.11 LABEL NO. 8820623, ELECTRICAL WARNING

5.12 LABEL NO. 8801408, ATTENTION: WATER CONNECTIONS AND RELIEF VALVE

ATTENTION

Water Connections

DO NOT apply heat to these fittings when making sweat connections to the heater. Sweat tubing to adapter before fitting the adapter to heater fittings. It is imperative that no heat be applied to these fittings because they contain a non-metallic liner.

Relief Valve

The relief valve installation temperature and pressure protective equipment is required by local codes, but not less than a combination temperature and pressure relief valve device certified as meeting the requirements in the listing requirements for ANSI Z21.22, "Relief Valves For Hot Water Supply Systems," by a nationally recognized testing laboratory that maintains periodic inspection of the production of listed equipment or materials. The relief valve shall be so oriented or provided with tubing that any discharge can exit only within 6" of or at any distance below the structural floor and will not contact any live electrical part. Omission or improper installation of the temperature and pressure relief valve voids the manufacturer's warranty and liability.

1909 8801408

5.13 LABEL NO. 31246, MUELLER NAME PLATE

MUELLER

5.14 LABEL NO. 8823999, ATTENTION: CONTROL CIRCUIT WIRING SPECIFICATIONS

ATTENTION

Please refer to the wiring diagram for control circuit wiring specifications.

1705 8823999

5.15 LABEL NO. 8824716, HFC REFRIGERANT

REFRIGERANT R-507
POE OIL

0305 8824716

5.16 LABEL NO. 8820454, IMPORTANT! DRY NITROGEN GAS

IMPORTANT

THIS EQUIPMENT CONTAINS A HOLDING CHARGE OF DRY NITROGEN GAS. SLOWLY RELEASE PRESSURE THROUGH SERVICE PORTS OR SCHRADER VALVES BEFORE REMOVING FITTINGS.

EVACUATE THE SYSTEM TO 500 MICRONS BEFORE CHARGING WITH REFRIGERANT. DISCARD THIS TAG UPON CHARGING SYSTEM WITH REFRIGERANT AND APPLY A SYSTEM REFRIGERANT SPECIFICATION DECAL.

NOTE: IT IS THE TECHNICIAN'S RESPONSIBILITY TO COMPLY WITH ALL CURRENT REFRIGERANT USAGE REGULATIONS.

(11/94) 8820454

5.17 LABEL NO. 8803611, FRE-HEATER MODEL "DE" DATA PLATE

Model "DE" Fre-Heater®

MODEL NUMBER | PART NUMBER | SERIAL NUMBER

TWO WIRES WITH GROUND

VOLTAGE | HZ | PHASE | WATTS

AMPERE | MINIMUM CIRCUIT AMPACITY | MAXIMUM FUSE SIZE

REFRIGERANT WORKING PRESSURE — PSIG / KPA

TANK WORKING/ TEST PRESSURE — PSIG / KPA

REFRIGERANT TYPE | NUMBER OF CIRCUITS | TANK CAPACITY | U.S. GALLONS

1705 1-800-MUELLER | WWW.PAULMUELLER.COM 8803611

5.18 LABEL NO. 31433, FRE-HEATER MODEL "D" DATA PLATE

Model "D" Fre-Heater®

MODEL NUMBER | PART NUMBER

SERIAL NUMBER | NUMBER OF CIRCUITS

REFRIGERANT WORKING PRESSURE — PSIG / KPA

TANK WORKING/ TEST PRESSURE — PSIG / KPA

REFRIGERANT TYPE | TANK CAPACITY | U.S. GALLONS

1710 1-800-MUELLER | WWW.PAULMUELLER.COM 31433

5.19 LABEL NO. 8824816, CRN

CRN NUMBER FOR BRITISH COLUMBIA: OH4249.1
CRN NUMBER FOR ALL OTHER PROVIDENCES: OH8902.5

0309 8824816

Section 6.0 – Appendix A

6.1 THERMAL EXPANSION TANK INSTALLATION FOR DAIRY FARM APPLICATIONS

Paul Mueller Company requires the installation of a thermal expansion tank on all Model "D" Fre-Heaters used on dairy farm applications.

IMPORTANT: Without the installation of the thermal expansion tank, the Fre-Heater warranty may be void at the discretion of the Mueller Dairy Farm Equipment Service Department.

Thermal expansion will occur in all closed tank water heating applications. For example, a closed tank with an initial pressure of 50 psig will reach a pressure of 250 psig with a temperature rise of just 10°F, or 40 gallons of water at 40°F will expand to 41 gallons at 160°F. The use of a thermal expansion tank will absorb these pressures and help eliminate premature Fre-Heater failure. The temperature pressure relief valve is intended as a safety device and should not be relied upon to perform this function.

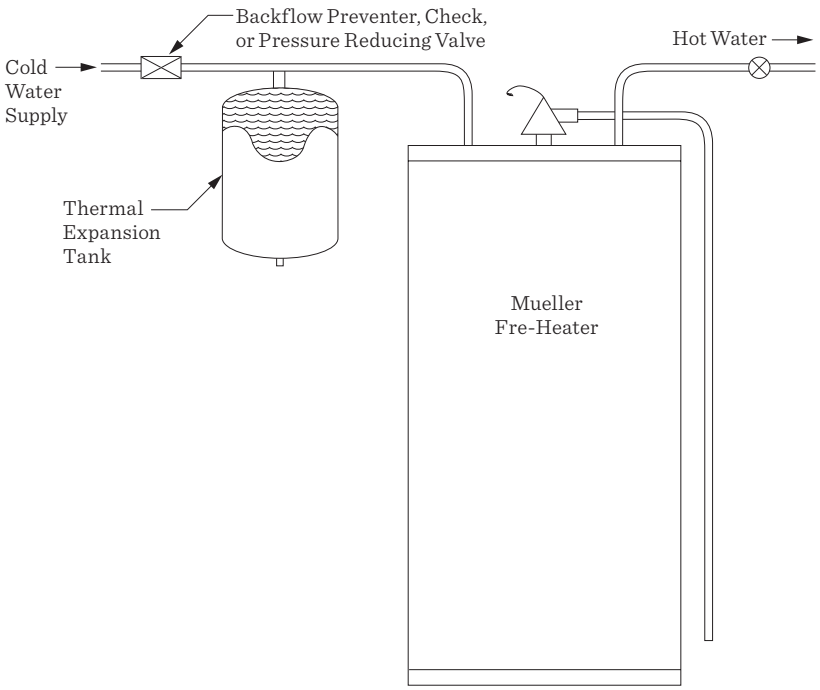
The following diagram shows the proper installation method for a thermal expansion tank. A thermal expansion tank, Mueller Part No. 8805175, is available and will work well for this application.

Please Note:

- One thermal expansion tank, Part No. 8805175, is required for every 120-gallon Fre-Heater and/or water heater storage capacity. For example, a Model D-120 Fre-Heater installed in series with a 120-gallon water heater would require two expansion tanks installed on the cold water supply line of the Model "D" Fre-Heater.

- The thermal expansion tank is shipped with 40 pounds of pressure on the diaphragm and must be pressurized to the cut-out pressure of the well pump before it is installed. For example, if the water supply is a 30 psig cut-in and 50 psig cut-out, then the proper pressure in the thermal expansion tank would be 50 psig.

FIGURE 21: THERMAL EXPANSION TANK DIAGRAM



PAUL
MUELLER
COMPANY

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